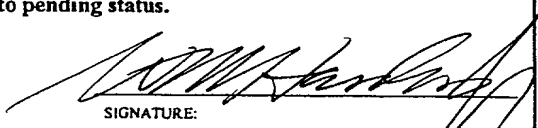


526 Rec'd PCT/PTO 15 AUG 2000

FORM PTO-1390 (REV 12-29-99)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER VAL-487-A	
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371				U.S. APPLICATION NO. (If known, see 37 CFR 1.5) 09/622356	
INTERNATIONAL APPLICATION NO. PCT/EP99/00637		INTERNATIONAL FILING DATE 01 February 1999		PRIORITY DATE CLAIMED 20 February 1998	
TITLE OF INVENTION FOUR-HINGED WIPER ARM FOR A WINDSHIELD WIPER SYSTEM					
APPLICANT(S) FOR DO/EO/US Wolfgang Scholl and Herbert Bienert					
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:					
<ol style="list-style-type: none"> 1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371. 2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371. 3. <input checked="" type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1). 4. <input type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date. 5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2)) <ol style="list-style-type: none"> a. <input checked="" type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau). b. <input type="checkbox"/> has been transmitted by the International Bureau. c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US). 6. <input checked="" type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)). 7. <input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)) <ol style="list-style-type: none"> a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau). b. <input type="checkbox"/> have been transmitted by the International Bureau. c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. d. <input type="checkbox"/> have not been made and will not be made. 8. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)). 9. <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). 10. <input type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)). 					
Items 11. to 16. below concern document(s) or information included:					
<ol style="list-style-type: none"> 11. <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98. 12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included. 13. <input checked="" type="checkbox"/> A FIRST preliminary amendment. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment. 14. <input checked="" type="checkbox"/> A substitute specification. 15. <input type="checkbox"/> A change of power of attorney and/or address letter. 16. <input checked="" type="checkbox"/> Other items or information: Red-lined Specification 					

534 Rec'd PCT/PTO 15 AUG 2000

U.S. APPLICATION NO. (if known) (37 CFR 1.5) 09/622356		INTERNATIONAL APPLICATION NO. PCT/EP99/00637		ATTORNEY'S DOCKET NUMBER VAL-487-A	
17. <input checked="" type="checkbox"/> The following fees are submitted: BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) : Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$970.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$840.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$690.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$670.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) \$96.00 ENTER APPROPRIATE BASIC FEE AMOUNT =				CALCULATIONS PTO USE ONLY	
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				\$ 0	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	- 20 =		X \$18.00	\$ 0	
Independent claims	- 3 =		X \$78.00	\$	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$260.00	\$	
TOTAL OF ABOVE CALCULATIONS =				\$ 840	
Reduction of 1/2 for filing by small entity, if applicable. A Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28).				\$ 0	
SUBTOTAL =				\$ 840	
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				\$ 0	
TOTAL NATIONAL FEE =				\$ 840	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property . +				\$ 0	
TOTAL FEES ENCLOSED =				\$ 840	
				Amount to be:	
				refunded	
				charged	
a. <input checked="" type="checkbox"/> A check in the amount of \$ <u>840.00</u> to cover the above fees is enclosed. b. <input type="checkbox"/> Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed. c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>25-0115</u> . A duplicate copy of this sheet is enclosed.					
NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.					
SEND ALL CORRESPONDENCE TO: Andrew R. Basile YOUNG & BASILE, PC 3001 West Big Beaver Road Suite 624 Troy, MI 48084 (248) 649-3333					
				SIGNATURE:  William M. Hanlon, Jr. NAME 28422 REGISTRATION NUMBER	

Our Reference: VAL-487-A

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Wolfgang Scholl and Herbert Bienert
Serial Number:	Unknown
Filing Date:	Concurrent
Examiner/Art Group Unit:	Unknown/Unknown
Title:	FOUR-HINGED WIPER ARM FOR A WINDSHIELD WIPER SYSTEM

PRELIMINARY AMENDMENT

Assistant Commissioner of Patents
Washington, D.C. 20231

Sir:

Entry of this preliminary amendment before the examination of the
above-identified application is respectfully requested.

After the claims, start a new page and insert –

ABSTRACT

5 The invention relates to a four-hinged wiper arm for a windshield
wiper system, especially for an automobile wherein a connecting rod is pivotally
connected to a driving arm in a first bearing point and to a control arm in a second
bearing point. A hinged part is coupled to the connecting rod. A wiper blade that can
be placed on the hinged part or on a wiper rod connected to the hinged part can be
pressed against the windshield to be wiped by a spring element that is mounted on the
four-hinged wiper arm. In order to ensure good wiping quality and low-noise
operation over a long service period, the invention provides that the connecting rod or
10 the driving arm or the control arm is fitted with an antifriction bearing at least one of
the two locating points of the four hinged wiper arm. According to advantageous
embodiments of the invention, the four-hinged wiper arm is fitted with an antifriction
bearing on both bearing points, whereby the antifriction bearing is preferably a deep
groove ball bearing. - -

In the claims:

Cancel claims 1 - 8 and insert new claims 9 - 16.

9. (New) A four-hinged wiper arm for a windshield wiper system, wherein a connecting rod is pivotally connected to a driving arm at a first bearing point and to a control arm at a second bearing point, a hinged part is coupled to the connecting rod and a wiper blade and placed on one of the hinged part and on a wiper rod connected to the hinged part can be pressed against the windshield to be wiped by a spring element that is mounted on the four-hinged wiper arm, characterized in that one of the connecting rod and the driving arm, and the control arm is provided with a rolling-contact bearing in at least one of the first and second bearing points of the four-hinged wiper arm.

1 10. (New) The four-hinged wiper arm according to Claim 9,
2 characterized in that at least one of the rolling-contact bearings is a deep groove ball
3 bearing.

1 11. (New) The four-hinged wiper arm according to claim 9
2 characterized in that the driving arm and the control arm are made of sheet metal.

1 12. (New) The four-hinged wiper arm according to claim 9
2 characterized in that the outer ring of the at least one rolling-contact bearing is axially
3 secured and held, so that it does not rotate in one recess of the connecting rod
4 whereas a bolt, attached to one of the driving arm and the control arm, is fitted into
5 the inner ring of the rolling-contact bearing and is axially secured and non-rotatably
6 held.

1 13. (New) The four-hinged wiper arm according to claim 12
2 characterized in that the bolt used on the at least one first and second bearing point is
3 a riveted bolt .

4 14. (New) The four-hinged wiper arm according to Claim 13,
5 characterized in that the riveted bolt is secured by wobble riveting in a passage one of
6 the driving arm and control arm, and by wobble riveting at an inner ring of the rolling-
7 contact bearing.

1 15. (New) The four-hinged wiper arm according to Claim 14,
2 characterized in that the riveted bolt has a radially protruding flange in a middle
3 region, with one side that rests against one of the driving arm and the control arm, and
4 another side that rests against a front surface of the inner ring of the rolling-contact
5 bearing.

1 16. (New) The four-hinged wiper arm according to claim, further
2 comprising a rolling-contact bearing with a deep groove ball bearing both at the first
3 bearing point between the connecting rod and the driving arm and at the second
4 bearing point between the connecting rod and the control arm.

REMARKS

After entry of this amendment, claims 9 through 16 are pending in the application. Claims 1 through 8 have been canceled without prejudice. Claims 9 - 16 have been added in this amendment.

It is submitted that this Amendment has antecedent basis in the application as originally filed, including the specification, claims and drawings, and that this Amendment does not add any new subject matter to the application.

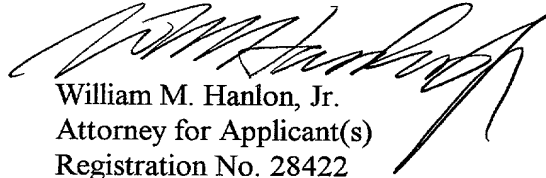
Consideration of the application as amended is requested.

A hand-written, corrected copy of the specification is enclosed showing the changes which have been made to the specification as required by Section 608.01(Q) and 714.20(1) of the Manual of Patent Examining Procedure. The Substitute Specification filed herewith has been amended to utilize idiomatic English, correct minor typographical and grammatical errors and to conform the application to current United States Patent practice. The Substitute Specification includes no new subject matter; but does include the same changes handwritten in red in the attached,

corrected, original specification. Entry of the Substitute Specification is respectfully requested.

Respectfully submitted,

YOUNG, BASILE, HANLON, MacFARLANE, WOOD
& HELMHOLDT, P.C.



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Dated: August 15, 2000
WMH/jao

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534 Rec'd PCT/PTO 15 AUG 2000

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SUBSTITUTE SPECIFICATION

Our Reference: VAL-487-A

PATENT

FOUR-HINGED WIPER ARM FOR A WINDSHIELD WIPER SYSTEM

BACKGROUND

5 The invention pertains to a four-hinged wiper arm for a windshield wiper system, especially for an automobile, wherein a connecting rod is connected to a driving arm at a first bearing point and to a control arm at a second bearing point so that it can pivot, a hinged part is coupled to the connecting rod, and a wiper blade that can be placed on the hinged part or on a wiper rod connected to the hinged part can be pressed against the windshield to be wiped by a spring element that is mounted on
10 the four-hinged wiper arm.

A four-hinged wiper arm of this kind has already become known from DE 42 14 679 A1. In this wiper arm, the connecting rod is connected to a driving arm at a first bearing point by means of a cylinder bolt so that it can pivot, and it is connected to a control arm at a second bearing point by means of a cylinder bolt so
15 that it can pivot, wherein the cylinder bolts are each mounted directly in a bearing hole of the connecting rod and/or a bearing hole of the driving arm and the control arm, respectively, so that they can rotate. Bearing points of this kind can be designed with a small structural height, however, they are not suitable for transferring with high efficiency, and without free play; the large radial and axial forces occurring
20 during operation of the wiper arm over long operating times. Even after a short operating time, interfering bearing play may occur, which, on the one hand, greatly reduces the wiping quality and, on the other hand, can result in an interfering formation of noise.

SUMMARY

25 The invention is based on the problem of improving a four-hinged wiper arm of the kind described above, in such a manner that the bearing points of the connecting rod with the driving arm and the control arm, respectively, satisfy the strict requirements, over the long term, with regard to high-efficiency, non-play transmission of large radial and axial forces.

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In the case of a four-hinged wiper arm according to this invention a connecting rod or the driving arm or the control arm is provided with a rolling-contact bearing on at least one of the two bearing points of the four-hinged wiper arm. Just the provision of one of the two bearing points with a rolling-contact bearing enables a more rigid and more exact control of the connecting rod over a longer operating time, in particular, when the bearing point of the connecting rod with the driving arm is equipped with a rolling-contact bearing. This will ensure good wiping quality and less noisy movement of the windshield wiper system over longer operating times.

In order to ensure a non-play bearing over a long operating time, even under very large radial and axial forces to be transferred, it is recommended to use a design such that at least one of the rolling-contact bearings is a deep groove ball bearing. Due to their design configuration, deep groove ball bearings are particularly well-suited for non-play transmission of large radial and axial forces.

However, a favorable embodiment of the invention provides that the four-hinged wiper arm is equipped with a rolling-contact bearing, preferably with a deep groove ball bearing, both at the first bearing point of the connecting rod with the driving arm, and also at the second bearing point of the connecting rod with the control rod. Bearing points designed in this manner can withstand large forces in the axial and radial direction over long periods of time with no damage, so that a four-hinged wiper arm designed in this manner can satisfy the significant requirements with regard to good wiping quality and low-noise operation over very long operating times.

BRIEF DESCRIPTION OF THE DRAWINGS

Additional favorable embodiments and other advantages and details of the invention will be explained in greater detail below with reference to the figures which describe one particular embodiment example. In the accompanying figures:

Figure 1 is a four-hinged wiper arm; and

Figure 2 is a vertical cross section along line II-II in Figure 1 through the connecting rod and the two bearing points.

DETAILED DESCRIPTION

The four-hinged wiper arm shown schematically in Figure 1 has the essential components of the four-hinged construction consisting of a connecting rod 1 with a first bearing point 2 and a second bearing point 3. The connecting rod 1 is pivotally mounted at the first bearing point 2 to one end of a driving arm 4 so that it can pivot about the first-bearing point 7. The connecting rod 1 is also pivotally connected at the second bearing point 3 to one end of a control arm 5. The other end of the driving arm 4 is attached to a pendulum-driveable wiper shaft (not shown) which is arranged in a chassis-mounted wiper bearing so that it can also rotate. The other end of the control arm 5 is fixed to a control shaft, which is arranged in a likewise chassis-mounted bearing so that it can rotate. Thus, an articulated rectangle is formed by the connecting rod 1, the driving arm 4, the control arm 5 and a chassis-mounted part of the vehicle running between the free ends of the driving arm 4 and the control arm 5.

In Figure 1, the connecting rod 1 is extended to the left past the bearing point 3. At this end a hinged part 7 is coupled to the connecting rod 1 so that it can pivot about an axis 6 running parallel to the windshield to be wiped. As an extension of the hinged part 7, a wiper rod 8 attached to the hinged part 7 can be seen, this wiper rod is designed in a known manner with a free end for connection to a wiper blade (not illustrated). It is essential to the invention that at each of the two bearing points 2 and 3 of the connecting rod 1, there is one rolling-contact bearing 9 in the form of a deep groove ball bearing 11 for the pivotable connection between the connecting rod 1 and the driving arm 4 and the control arm 5, respectively.

Additional details of the invention are visible from the enlarged, schematic illustration (with respect to Figure 1) that is presented in Figure 2. The connecting rod 1 shown in Figure 2 consists of metal and, in the region of the first bearing point 2 and in the region of the second bearing point 3, it has essentially the same design. The only difference consists in that the connecting rod 1 is connected to the driving arm 4 at the first bearing point 2 so that it can pivot and it is connected to the control arm 5 at the second bearing point 3 so that it can also pivot. At the two bearing points 2 and 3, the

connecting rod 1 has a recess 10 into which the outer ring of a deep groove ball bearing 11 is fit. The fit is structured so that the deep groove ball bearing 11 is axially fixed in the recess 10 and will not turn. For a particularly dependable axial mount, the edges of the recess 10 are caulked locally or around the perimeter. In this regard, it should be pointed out that the deep groove ball bearing 11 is shown only schematically in the drawing for reasons of simplicity. Since deep groove ball bearings are a standard part already known in the technical world, a more detailed illustration and description can be omitted at this point.

In the event that the connecting rod 1 is made of a plastic material, the at least one rolling-contact bearing 9 or deep groove ball bearing 11 can be injection molded into the connecting rod 1.

It is clearly evident, in particular in Figure 1, that the connection between the driving arm 4 or the control arm 5 and the connecting rod 1 takes place by means of a riveted bolt 12. The upper end of the riveted bolt 12 is fit into the inner ring of the deep groove ball bearing 11, and the lower end of the riveted bolt 12 is fit into a passage 13 in the driving arm 4 or the control arm 5. Whereas in the middle region of the riveted bolt 12 there is a narrow, radially protruding flange 14 whose one side rests against the inner ring of the deep groove ball bearing 11 and whose other side rests against the driving arm 4 or control arm 5. The opposing ends of the riveted bolt are each mounted in place axially by wobble riveting and are connected rotation-tight to the inner ring of the deep groove ball bearing 11 or to the driving arm 4 or control arm 5 so that they do not rotate. Due to the flange 14 of the riveted bolt 12, on the one hand, the spacing between the driving arm 4 or control arm 5 and the connecting rod 1--necessary for mobility--will be assured, and, on the other hand, a stable connection of the riveted bolt 12 to the deep groove ball bearing 11 and to the driving arm 4 or control arm 5 will be assured.

In the described four-hinged wiper arm, both the driving arm 4 and also the control arm 5 are Manufactured as stamped sheet metal parts. The advantage of this is that the four-hinged wiper arm, in particular in the region of the four-hinged construction, can be produced at a small structural height. However, the connecting rod 1

has a greater thickness than the driving arm 4 or control arm 5. On the other hand, since the rolling-contact bearing 9 or deep groove ball bearing 11 necessarily must have a particular structural height, it is an advantage to fix the rolling-contact bearing 9 or deep groove ball bearing 11 to the connecting rod 1. This will assure a dependable and stable mount of the rolling-contact bearing 9 or deep groove ball bearing 11 to the connecting rod 1. With a different design of the driving arm 4 or the control arm 5 with sufficient thickness in the region of the bearing point 2 or 3, for example, as a cast metal part or as an injection molded plastic part, the corresponding rolling-contact bearing 9 or deep groove ball bearing 11 can also be held against the driving arm 4 or control arm 5, whereas the bolt 12, on the other hand, is directly mounted to the connecting rod 1.

When using a riveted bolt 12 to generate the connection between the connecting rod 1 and the driving arm 4 or control arm 5 by means of a rolling-contact bearing 9 or deep groove ball bearing 11, a cost-effective assembly or manufacture can be obtained by means of wobble riveting. With wobble riveting of the riveted bolt 12 on both sides, the flange 14 formed in the middle region of the bolt 12 will ensure a good support against the forces generated during the riveting process.

Since the function and operation of a four-hinged wiper arm is generally known to a person skilled in the art, it need not be described in further detail here.

What is Claimed is:

1 1. Four-hinged wiper arm for a windshield wiper system, especially
2 for an automobile, wherein a connecting rod (1) is connected to a driving arm (4) at a
3 first bearing point (2) and to a control arm (5) at a second bearing point (3), so that it can
4 pivot, a hinged part (7) is coupled to the connecting rod (1), and a wiper blade that can
5 be placed on the hinged part or on a wiper rod (8) connected to the hinged part can be
6 pressed against the windshield to be wiped by a spring element that is mounted on the
7 four-hinged wiper arm, characterized in that the connecting rod (1) or the driving arm (4)
8 or the control arm (5) is provided with a rolling-contact bearing (9) in at least one of the
9 two bearing points (2, 3) of the four-hinged wiper arm.

1 2. Four-hinged wiper arm according to Claim 1, characterized in that
2 at least one of the rolling-contact bearings (9) is a deep groove ball bearing (11).

1 3. Four-hinged wiper arm according to at least one of the preceding
2 claims, characterized in that the outer ring of the at least one rolling-contact bearing (9,
3 11) is axially secured and held, preferably pressed, so that it does not rotate in one recess
4 (10) of the connecting rod (1), whereas a bolt (12) attached to the driving arm (4) or to
5 the control arm (5) is fitted into the inner ring of the rolling-contact bearing and is axially
6 secured and held so that it does not rotate.

1 4. Four-hinged wiper arm according to one of the preceding claims,
2 characterized in that the driving arm (4) and the control arm (5) are made of sheet metal,
3 preferably as stamped parts.

1 5. Four-hinged wiper arm according to at least one of the preceding
2 claims, characterized in that the bolt used on the at least one bearing point (2, 3) is a
3 riveted bolt (12).

4 6. Four-hinged wiper arm according to Claim 5, characterized in that
5 the riveted bolt (12), is secured, on one hand, by wobble riveting in a passage (13) of the
6 driving arm (4) or control arm (5), and on the other hand by wobble riveting at the inner
7 ring of the rolling-contact bearing (9, 11).

1 7. Four-hinged wiper arm according to Claim G, characterized in that
2 the riveted bolt (12) has a radially protruding flange (14) in its middle region, with one
3 side that rests against the driving arm (4) or control arm (5) and the other side rests
4 against the front surface of the inner ring of the rolling-contact bearing (9, 11).

1 8. Four-hinged wiper arm according to at least one of the preceding
2 claims, characterized in that it is equipped with a rolling-contact bearing (9), preferably
3 with a deep groove ball bearing (11), both at the first bearing point (2) between the
4 connecting rod (1) and the driving arm (4), and also at the second bearing point (3)
5 between the connecting rod (1) and the control rod (5).

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FOUR-HINGED WIPER ARM FOR A
WINDSHIELD WIPER SYSTEM(cap,
center
line)

534 Rec'd PCT/PTO 15 AUG 2000

[Published with international search report. Before expiration of the deadline established for submission of amendments. Will be republished if amendments are submitted.]

BACKGROUND

The invention pertains to a four-hinged wiper arm for a windshield wiper system, especially for an automobile, wherein a connecting rod is connected to a driving arm at a first bearing point and to a control arm at a second bearing point so that it can pivot, a hinged part is coupled to the connecting rod, and a wiper blade that can be placed on the hinged part or on a wiper rod connected to the hinged part can be pressed against the windshield to be wiped by a spring element that is mounted on the four-hinged wiper arm.

A four-hinged wiper arm of this kind has already become known from DE 42 14 679 A1. In this wiper arm, the connecting rod is connected to a driving arm at a first bearing point by means of a cylinder bolt so that it can pivot, and it is connected to a control arm at a second bearing point by means of a cylinder bolt so that it can pivot, wherein the cylinder bolts are each mounted directly in a bearing hole of the connecting rod and/or a bearing hole of the driving arm and the control arm, respectively, so that they can rotate. Bearing points of this kind can be designed with a small structural height, however, they are not suitable for transferring with high efficiency, and without free play; the large radial and axial forces occurring during operation of the wiper arm over long operating times. Even after a short operating time, interfering bearing play may occur, which on the one hand greatly reduces the wiping quality and on the other hand, can result in an interfering formation of noise.

SUMMARY

The invention is based on the problem of improving a four-hinged wiper arm of the kind described above, in such a manner that the bearing points of the connecting rod with the driving arm and the control arm, respectively, satisfy the strict requirements, over the long term, with regard to high-efficiency, non-play transmission of large radial and axial forces.

In the case of a four-hinged wiper arm [with the properties of the preamble of Claim 1, the problem is solved] according to this invention [in that the connecting rod or the driving arm or the control arm is provided with a rolling-contact bearing on at least one of the two bearing points of the four-hinged wiper arm. Just the provision of

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one of the two bearing points with a rolling-contact bearing enables a more rigid and more exact control of the connecting rod over a longer operating time, in particular, when the bearing point of the connecting rod with the driving arm is equipped with a rolling-contact bearing. This will ensure good wiping quality and less noisy movement of the windshield wiper system over longer operating times.

In order to ensure a non-play bearing over a long operating time, even under very large radial and axial forces to be transferred, [in the embodiment of the invention according to Claim 2] it is recommended to use a design such that at least one of the rolling-contact bearings is a deep groove ball bearing. Due to their design configuration, deep groove ball bearings are particularly well-suited for non-play transmission of large radial and axial forces.

However, a favorable embodiment of the invention [according to ~~Claim~~ 8] provides that the four-hinged wiper arm is equipped with a rolling-contact bearing, preferably with a deep groove ball bearing, both at the first bearing point of the connecting rod (1) with the driving arm, and also at the second bearing point of the connecting rod with the control rod. Bearing points designed in this manner can withstand large forces in the axial and radial direction over long periods of time with no damage, so that a four-hinged wiper arm designed in this manner can satisfy the significant requirements with regard to good wiping quality and low-noise operation over very long operating times.

BRIEF DESCRIPTION OF THE DRAWINGS

Additional favorable embodiments [result from the subordinate claims] and other advantages and details of the invention will be explained in greater detail below with reference to the figures which describe one particular embodiment example. [The] In the accompanying figures [show]:

Figure 1, ¹a four-hinged wiper arm, ²and

Figure 2, ¹²a vertical cross section along line II-II in Figure 1 through the connecting rod and the two bearing points.

DETAILED DESCRIPTION

The four-hinged wiper arm shown schematically in Figure 1 has the essential components of the four-hinged construction consisting of connecting rod 1 with a first bearing point 2 and a second bearing point 3. The connecting rod 1 is pivotally

mounted at the first bearing point 2 to one end of a driving arm 4 so that it can pivotally [about the first bearing point 2] and the connecting rod 1 is also pivotally connected at the second bearing point 3 to one end of a

control arm 5 ^{also} so that it can pivot. The other end of the driving arm 4 is attached to a pendulum-driveable wiper shaft (not shown) which is arranged in a chassis-mounted wiper bearing so that it can rotate, ^{The} and the other end of the control arm 5 is fixed to a control shaft, which is arranged in a likewise chassis-mounted bearing so that it can ^{also} rotate. Thus, an articulated rectangle is formed by the connecting rod 1, the driving arm 4, the control arm 5 and a chassis-mounted part of the vehicle running between the free ends of the driving arm 4 and the control arm 5.

In Figure 1, ^{the} connecting rod 1 is extended to the left past the bearing point 3. At this end a hinged part 7 is coupled to the connecting rod 1 so that it can pivot about an axis 6 running parallel to the windshield to be wiped. As an extension of the hinged part 7, a wiper rod 8 attached to the hinged part 7 can be seen, ^{This} this wiper rod is designed in a known manner with a free end for connection to a wiper blade (not illustrated). It is essential to the invention that at each of the two bearing points 2 and 3 of the connecting rod 1, there is one rolling-contact bearing 9 in the form of a deep groove ball bearing 11 for the pivotable connection between the connecting rod 1 and the driving arm 4 and the control arm 5, respectively.

Additional details of the invention are visible from the enlarged, schematic illustration (with respect to Figure 1) that is presented in Figure 2. The connecting rod 1 shown in Figure 2 consists of metal and ⁱⁿ in the region of the first bearing point 2 and in the region of the second bearing point 3, ^{it} it has essentially the same design. The only difference consists in that the connecting rod 1 is connected to the driving arm 4 at the first bearing point 2 so that it can pivot and it is connected to the control arm 5 at the second bearing point 3 so that it ^{also} can pivot. At the two bearing points 2 and 3, the connecting rod 1 has a recess 10 into which the outer ring of a deep groove ball bearing 11 is fit. The fit is structured so that the deep groove ball bearing 11 is axially fixed in the recess 10 and will not turn. For a particularly dependable axial mount, the edges of the recess 10 are caulked locally or around the perimeter. In this regard, it should be pointed out that the deep groove ball bearing 11 is shown only schematically in the drawing for reasons of simplicity. Since deep groove ball bearings are a standard part already known in the technical world, a more detailed illustration and description can be omitted at this point.

In the event that the connecting rod 1 is made of a plastic material, the at least one rolling-contact bearing 9 or deep groove ball bearing 11 can be injection molded into the connecting rod 1.

It is clearly evident, in particular in Figure 1, that the connection between the driving arm 4 or the control arm 5 and the connecting rod 1 takes place by means of a riveted bolt 12. The upper end of the riveted bolt 12 is fit into the inner ring of the deep groove ball bearing 11, and the lower end of the riveted bolt 12 is fit into a passage 13 in the driving arm 4 or the control arm 5. Whereas in the middle region of the riveted bolt 12 there is a narrow, radially protruding flange 14 whose one side rests against the inner ring of the deep groove ball bearing 11 and whose other side rests against the driving arm 4 or control arm 5. ^{The} opposing ends of the riveted bolt are each mounted in place axially by wobble riveting and are connected rotation-tight to the inner ring of the deep groove ball bearing 11 or to the driving arm 4 or control arm 5 so that they do not rotate. Due to the flange 14 of the riveted bolt 12, on the one hand, the spacing between the driving arm 4 or control arm 5 and the connecting rod 1--necessary for mobility--will be assured, and, on the other hand, a stable connection of the riveted bolt 12 to the deep groove ball bearing 11 and to the driving arm 4 or control arm 5 will be assured.

In the described four-hinged wiper arm, both the driving arm 4 and also the control arm 5 are manufactured as stamped sheet metal parts. The advantage of this is that the four-hinged wiper arm, in particular in the region of the four-hinged construction, can be produced at a small structural height. However, the connecting rod 1 has a greater thickness than the driving arm 4 or control arm 5. On the other hand, since the rolling-contact bearing 9 or deep groove ball bearing 11 necessarily must have a particular structural height, it is an advantage to fix the rolling-contact bearing 9 or deep groove ball bearing 11 to the connecting rod 1. This will assure a dependable and stable mount of the rolling-contact bearing 9 or deep groove ball bearing 11 to the connecting rod 1. With a different design of the driving arm 4 or the control arm 5 with sufficient thickness in the region of the bearing point 2 or 3, for example, as a cast metal part or as an injection molded plastic part, the corresponding rolling-contact bearing 9 or deep groove ball bearing 11 can also be held against the

driving arm 4 or control arm 5, whereas the bolt 12, on the other hand, is directly mounted to the connecting rod 1.

When using a riveted bolt 12 to generate the connection between the connecting rod 1 and the driving arm 4 or control arm 5 by means of a rolling-contact bearing 9 or deep groove ball bearing 11, a cost-effective assembly or manufacture can be obtained by means of wobble riveting. With wobble riveting of the riveted bolt 12 on both sides, the flange 14 formed in the middle region of the bolt 12 will ensure a good support against the forces generated during the riveting process.

Since the function and operation of a four-hinged wiper arm is generally known to a person skilled in the art, it need not be described in further detail here.

List of Reference Symbols

- | | |
|----|--------------------------|
| 1 | Connecting rod |
| 2 | (first) bearing point |
| 3 | (second) bearing point |
| 4 | Driving arm |
| 5 | Control arm |
| 6 | Axis |
| 7 | Hinged part |
| 8 | Wiper rod |
| 9 | Rolling-contact bearing |
| 10 | Recess |
| 11 | Deep groove ball bearing |
| 12 | Riveted bolt |
| 13 | Passage |
| 14 | Flange |

Claims *What is claimed:*

1. Four-hinged wiper arm for a windshield wiper system, especially for an automobile, wherein a connecting rod (1) is connected to a driving arm (4) at a first bearing point (2) and to a control arm (5) at a second bearing point (3), so that it can pivot, a hinged part (7) is coupled to the connecting rod (1), and a wiper blade that can be placed on the hinged part or on a wiper rod (8) connected to the hinged part

can be pressed against the windshield to be wiped by a spring element that is mounted on the four-hinged wiper arm, characterized in that the connecting rod (1) or the driving arm (4) or the control arm (5) is provided with a rolling-contact bearing (9) in at least one of the two bearing points (2, 3) of the four-hinged wiper arm.

2. Four-hinged wiper arm according to Claim 1, characterized in that at least one of the rolling-contact bearings (9) is a deep groove ball bearing (11).

3. Four-hinged wiper arm according to at least one of the preceding claims, characterized in that the outer ring of the at least one rolling-contact bearing (9, 11) is axially secured and held, preferably pressed, so that it does not rotate in one recess (10) of the connecting rod (1), whereas a bolt (12) attached to the driving arm (4) or to the control arm (5) is fitted into the inner ring of the rolling-contact bearing and is axially secured and held so that it does not rotate.

4. Four-hinged wiper arm according to one of the preceding claims, characterized in that the driving arm (4) and the control arm (5) are made of sheet metal, preferably as stamped parts.

5. Four-hinged wiper arm according to at least one of the preceding claims, characterized in that the bolt used on the at least one bearing point (2, 3) is a riveted bolt (12).

6. Four-hinged wiper arm according to Claim 5, characterized in that the riveted bolt (12), is secured, on one hand, by wobble riveting in a passage (13) of the driving arm (4) or control arm (5), and on the other hand by wobble riveting at the inner ring of the rolling-contact bearing (9, 11).

7. Four-hinged wiper arm according to Claim G, characterized in that the riveted bolt (12) has a radially protruding flange (14) in its middle region, with one side that rests against the driving arm (4) or control arm (5) and the other side rests against the front surface of the inner ring of the rolling-contact bearing (9, 11).

8. Four-hinged wiper arm according to at least one of the preceding claims, characterized in that it is equipped with a rolling-contact bearing (9), preferably with a deep groove ball bearing (11), both at the first bearing point (2) between the connecting rod (1) and the driving arm (4), and also at the second bearing point (3) between the connecting rod (1) and the control rod (5).

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The invention pertains to a four-hinged wiper arm for a windshield wiper system, especially for an automobile, wherein a connecting rod is connected to a driving arm at a first bearing point and to a control arm at a second bearing point so that it can pivot, a hinged part is coupled to the connecting rod, and a wiper blade that can be placed on the hinged part or on a wiper rod connected to the hinged part can be pressed against the windshield to be wiped by a spring element that is mounted on the four-hinged wiper arm.

A four-hinged wiper arm of this kind has already become known from DE 42 14 679 A1. In this wiper arm, the connecting rod is connected to a driving arm at a first bearing point by means of a cylinder bolt so that it can pivot, and it is connected to a control arm at a second bearing point by means of a cylinder bolt so that it can pivot, wherein the cylinder bolts are each mounted directly in a bearing hole of the connecting rod and/or a bearing hole of the driving arm and the control arm, respectively, so that they can rotate. Bearing points of this kind can be designed with a small structural height, however, they are not suitable for transferring with high efficiency, and without free play, the large radial and axial forces occurring during operation of the wiper arm over long operating times. Even after a short operating time, interfering bearing play may occur, which on the one hand greatly reduces the wiping quality and on the other hand, can result in an interfering formation of noise.

The invention is based on the problem of improving a four-hinged wiper arm of the kind described above, in such a manner that the bearing points of the connecting rod with the driving arm and the control arm, respectively, satisfy the strict requirements, over the long term, with regard to high-efficiency, non-play transmission of large radial and axial forces.

In the case of a four-hinged wiper arm with the properties of the preamble of Claim 1, the problem is solved according to this invention in that the connecting rod or the driving arm or the control arm is provided with a rolling-contact bearing on at least one of the two bearing points of the four-hinged wiper arm. Just the provision of one of the two bearing points with a rolling-contact bearing enables a more rigid and more exact control of the connecting rod over a longer operating time, in particular when the bearing point of the connecting rod with the driving arm is equipped with a rolling-contact bearing. This will ensure good wiping quality and less noisy movement of the windshield wiper system over longer operating times.

In order to ensure a non-play bearing over a long operating time, even under very large radial and axial forces to be transferred, in the embodiment of the invention according to Claim 2 it is recommended to use a design such that at least one of the rolling-contact bearings is a deep

groove ball bearing. Due to their design configuration, deep groove ball bearings are particularly well-suited for non-play transmission of large radial and axial forces.

However, a favorable embodiment of the invention according to [Claim] 8 provides that the four-hinged wiper arm is equipped with a rolling-contact bearing, preferably with a deep groove ball bearing, both at the first bearing point of the connecting rod (1) with the driving arm, and also at the second bearing point of the connecting rod with the control rod. Bearing points designed in this manner can withstand large forces in the axial and radial direction over long periods of time with no damage, so that a four-hinged wiper arm designed in this manner can satisfy the significant requirements with regard to good wiping quality and low-noise operation over very long operating times.

Additional favorable embodiments result from the subordinate claims, and other advantages and details of the invention will be explained in greater detail below with reference to the figures which describe one particular embodiment example. The accompanying figures show:

Figure 1, a four-hinged wiper arm and

Figure 2, a vertical cross section along line II-II in Figure 1 through the connecting rod and the two bearing points.

The four-hinged wiper arm shown schematically in Figure 1 has the essential components of the four-hinged construction consisting of connecting rod 1 with a first bearing point 2 and a second bearing point 3. The connecting rod 1 is pivotally mounted at the first bearing point 2 to one end of a driving arm 4 so that it can pivot, and the connecting rod 1 is connected at the second bearing point 3 to one end of a control arm 5 so that it can pivot. The other end of the driving arm 4 is attached to a pendulum-driveable wiper shaft (not shown) which is arranged in a chassis-mounted wiper bearing so that it can rotate, and the other end of the control arm 5 is fixed to a control shaft, which is arranged in a likewise chassis-mounted bearing so that it can rotate. Thus, an articulated rectangle is formed by the connecting rod 1, the driving arm 4, the control arm 5 and a chassis-mounted part of the vehicle running between the free ends of the driving arm 4 and the control arm 5.

In Figure 1 the connecting rod 1 is extended to the left past the bearing point 3. At this end a hinged part 7 is coupled to the connecting rod 1 so that it can pivot about an axis 6 running parallel to the windshield to be wiped. As an extension of the hinged part 7, a wiper rod 8 attached to the hinged part 7 can be seen, this wiper rod is designed in a known manner with a free end for connection to a wiper blade (not illustrated). It is essential to the invention that at each of the two bearing points 2 and 3 of the connecting rod 1, there is one rolling-contact bearing 9 in the form of a deep groove ball bearing 11 for the pivotable connection between the connecting rod 1 and the driving arm 4 and the control arm 5, respectively.

Additional details of the invention are visible from the enlarged, schematic illustration (with respect to Figure 1) that is presented in Figure 2. The connecting rod 1 shown in Figure 2 consists of metal and in the region of the first bearing point 2 and in the region of the second bearing point 3, it has essentially the same design. The only difference consists in that the connecting rod 1 is connected to the driving arm 4 at the first bearing point 2 so that it can pivot and it is connected to the control arm 5 at the second bearing point 3 so that it can pivot. At the two bearing points 2 and 3, the connecting rod 1 has a recess 10 into which the outer ring of a deep groove ball bearing 11 is fit. The fit is structured so that the deep groove ball bearing 11 is axially fixed in the recess 10 and will not turn. For a particularly dependable axial mount, the edges of the recess 10 are caulked locally or around the perimeter. In this regard, it should be pointed out that the deep groove ball bearing 11 is shown only schematically in the drawing for reasons of simplicity. Since deep groove ball bearings are a standard part already known in the technical world, a more detailed illustration and description can be omitted at this point.

In the event that the connecting rod 1 is made of a plastic material, the at least one rolling-contact bearing 9 or deep groove ball bearing 11 can be injection molded into the connecting rod 1.

It is clearly evident, in particular in Figure 1, that the connection between the driving arm 4 or the control arm 5 and the connecting rod 1 takes place by means of a riveted bolt 12. The upper end of the riveted bolt 12 is fit into the inner ring of the deep groove ball bearing 11, and the lower end of the riveted bolt 12 is fit into a passage 13 in the driving arm 4 or the control arm 5. Whereas in the middle region of the riveted bolt 12 there is a narrow, radially protruding flange 14 whose one side rests against the inner ring of the deep groove ball bearing 11 and whose other side rests against the driving arm 4 or control arm 5, the opposing ends of the riveted bolt are each mounted in place axially by wobble riveting and are connected rotation-tight to the inner ring of the deep groove ball bearing 11 or to the driving arm 4 or control arm 5 so that they do not rotate. Due to the flange 14 of the riveted bolt 12, on the one hand, the spacing between the driving arm 4 or control arm 5 and the connecting rod 1--necessary for mobility--will be assured, and on the other hand, a stable connection of the riveted bolt 12 to the deep groove ball bearing 11 and to the driving arm 4 or control arm 5 will be assured.

In the described four-hinged wiper arm, both the driving arm 4 and also the control arm 5 are manufactured as stamped sheet metal parts. The advantage of this is that the four-hinged wiper arm, in particular in the region of the four-hinged construction, can be produced at a small structural height. However, the connecting rod 1 has a greater thickness than the driving arm 4 or control arm 5. On the other hand, since the rolling-contact bearing 9 or deep groove ball bearing 11 necessarily must have a particular structural height, it is an advantage to fix the rolling-contact bearing 9 or deep groove ball bearing 11 to the connecting rod 1. This will assure a dependable

and stable mount of the rolling-contact bearing 9 or deep groove ball bearing 11 to the connecting rod 1. With a different design of the driving arm 4 or the control arm 5 with sufficient thickness in the region of the bearing point 2 or 3, for example, as a cast metal part or as an injection molded plastic part, the corresponding rolling-contact bearing 9 or deep groove ball bearing 11 can also be held against the driving arm 4 or control arm 5, whereas the bolt 12, on the other hand, is directly mounted to the connecting rod 1.

When using a riveted bolt 12 to generate the connection between the connecting rod 1 and the driving arm 4 or control arm 5 by means of a rolling-contact bearing 9 or deep groove ball bearing 11, a cost-effective assembly or manufacture can be obtained by means of wobble riveting. With wobble riveting of the riveted bolt 12 on both sides, the flange 14 formed in the middle region of the bolt 12 will ensure a good support against the forces generated during the riveting process.

Since the function and operation of a four-hinged wiper arm is generally known to a person skilled in the art, it need not be described in further detail here.

List of Reference Symbols

- | | |
|----|--------------------------|
| 1 | Connecting rod |
| 2 | (first) bearing point |
| 3 | (second) bearing point |
| 4 | Driving arm |
| 5 | Control arm |
| 6 | Axis |
| 7 | Hinged part |
| 8 | Wiper rod |
| 9 | Rolling-contact bearing |
| 10 | Recess |
| 11 | Deep groove ball bearing |
| 12 | Riveted bolt |
| 13 | Passage |
| 14 | Flange |

Claims

1. Four-hinged wiper arm for a windshield wiper system, especially for an automobile, wherein a connecting rod (1) is connected to a driving arm (4) at a first bearing point (2) and to a control arm (5) at a second bearing point (3), so that it can pivot, a hinged part (7) is coupled to the connecting rod (1), and a wiper blade that can be placed on the hinged part or on a wiper rod

(8) connected to the hinged part can be pressed against the windshield to be wiped by a spring element that is mounted on the four-hinged wiper arm, characterized in that the connecting rod (1) or the driving arm (4) or the control arm (5) is provided with a rolling-contact bearing (9) in at least one of the two bearing points (2, 3) of the four-hinged wiper arm.

2. Four-hinged wiper arm according to Claim 1, characterized in that at least one of the rolling-contact bearings (9) is a deep groove ball bearing (11).

3. Four-hinged wiper arm according to at least one of the preceding claims, characterized in that the outer ring of the at least one rolling-contact bearing (9, 11) is axially secured and held, preferably pressed, so that it does not rotate in one recess (10) of the connecting rod (1), whereas a bolt (12) attached to the driving arm (4) or to the control arm (5) is fitted into the inner ring of the rolling-contact bearing and is axially secured and held so that it does not rotate.

4. Four-hinged wiper arm according to one of the preceding claims, characterized in that the driving arm (4) and the control arm (5) are made of sheet metal, preferably as stamped parts.

5. Four-hinged wiper arm according to at least one of the preceding claims, characterized in that the bolt used on the at least one bearing point (2, 3) is a riveted bolt (12).

6. Four-hinged wiper arm according to Claim 5, characterized in that the riveted bolt (12), is secured, on one hand, by wobble riveting in a passage (13) of the driving arm (4) or control arm (5), and on the other hand by wobble riveting at the inner ring of the rolling-contact bearing (9, 11).

7. Four-hinged wiper arm according to Claim 6, characterized in that the riveted bolt (12) has a radially protruding flange (14) in its middle region, with one side that rests against the driving arm (4) or control arm (5) and the other side rests against the front surface of the inner ring of the rolling-contact bearing (9, 11).

8. Four-hinged wiper arm according to at least one of the preceding claims, characterized in that it is equipped with a rolling-contact bearing (9), preferably with a deep groove ball bearing (11), both at the first bearing point (2) between the connecting rod (1) and the driving arm (4), and also at the second bearing point (3) between the connecting rod (1) and the control rod (5).

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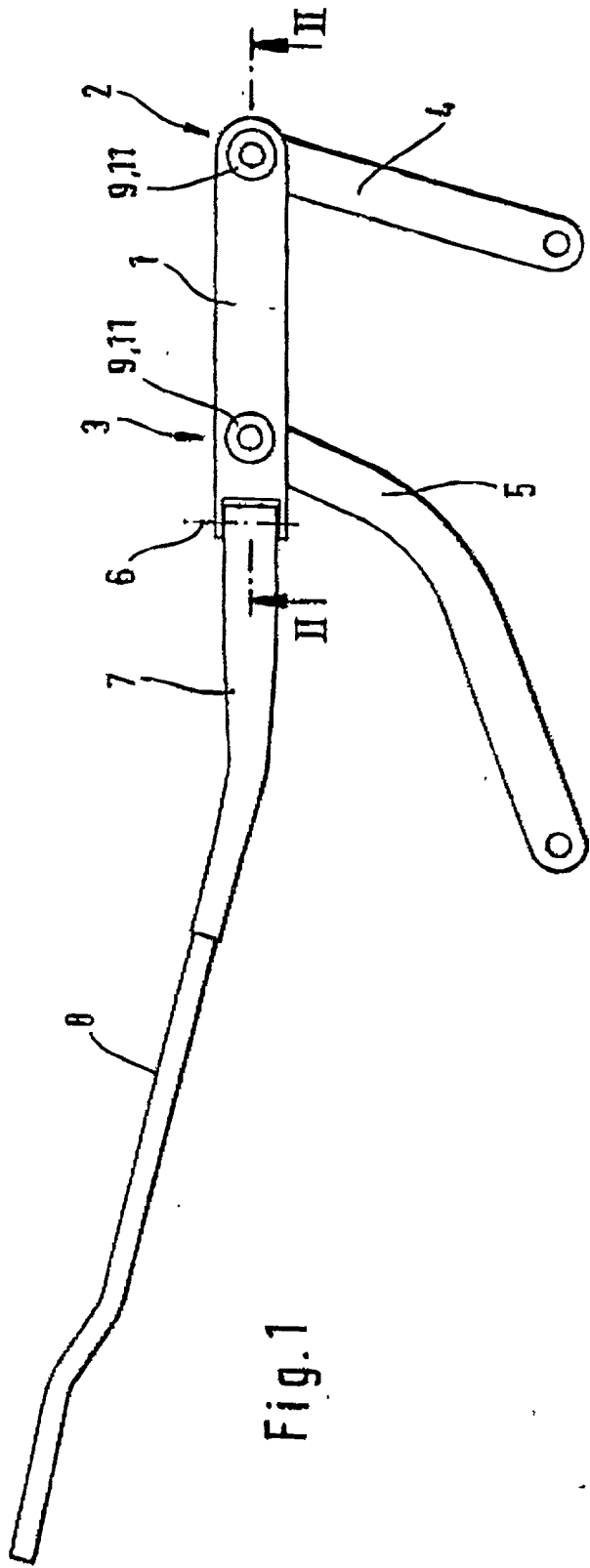
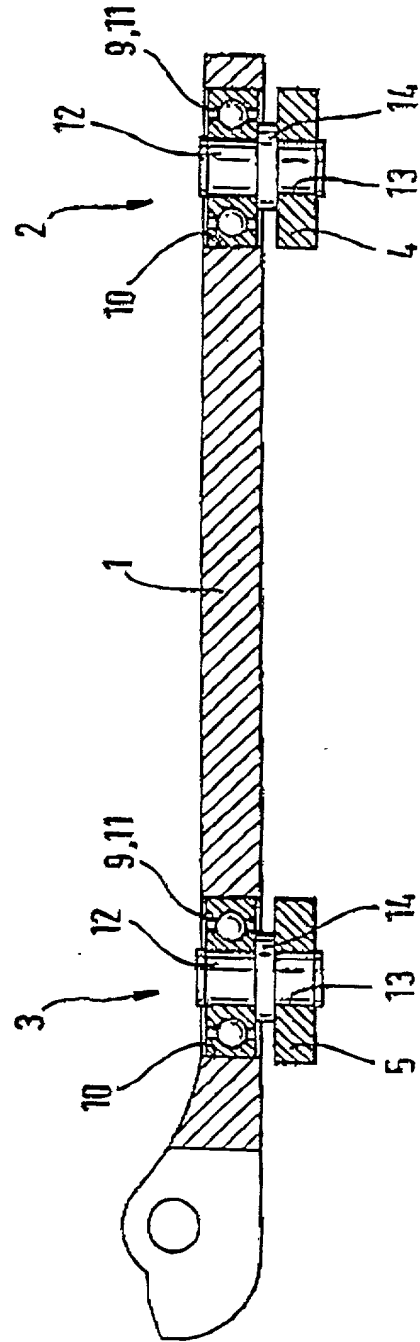


Fig. 2



Declaration and Power of Attorney for Patent Application

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German Language Declaration

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I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

FOUR-HINGED WIPER ARM FOR A
WIPER SYSTEM

the specification of which is attached hereto unless the following box is checked:

- ☒ was filed on 1 February 1999 as United States Application Number or PCT International Application Number PCT/EP99 00637 and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

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[Page 1 of 3]

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German Language Declaration

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(Application No.) (Filing Date)
(Aktenzeichen) (Anmeldetag)

(Application No.) (Filing Date)
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(Application No.) (Filing Date)
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Priority Not Claimed
Priorität nicht beansprucht

20 February 1998 ☐
(Day/Month/Year Filed)
(Tag/Monat/Jahr der Anmeldung)

(Day/Month/Year Filed) ☐
(Tag/Monat/Jahr der Anmeldung)

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below.

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s), or § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

(Status) (patented, pending, abandoned)
(Status) (patentiert, schwebend, aufgegeben)

(Status) (patented, pending, abandoned)
(Status) (patentiert, schwebend, aufgegeben)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

German Language Declaration

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POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: (list name and registration number)

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Staatsangehörigkeit	Citizenship	German
Postanschrift	Post Office Address	Same as above
Vor- und Zuname des zweiten Miterfinders (falls zutreffend)	Full name of second joint inventor, if any	Herbert BIENERT
Unterschrift des zweiten Erfinders	Second Inventor's signature	<i>[Signature]</i>
Datum	Date	07/24/2000
Wohnsitz	Residence	Ahornweg 15 D-74354 Bidigheim, Germany
Staatsangehörigkeit	Citizenship	German
Postanschrift	Post Office Address	Same as above

(Im Falle dritter und weiterer Miterfinder sind die entsprechenden Informationen und Unterschriften hinzuzufügen.)

(Supply similar information and signature for third and subsequent joint inventors.)